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(54) Title: TREATMENT OF FABRIC MATERIALS WITH AN INSECTICIDE

(57) Abstract: The invention relates to an insecticide composition for application to a fabric material, typically a fabric material that forms a mosquito net. The composition includes an insecticide and a copolymeric binder that permits application of the insecticide to a fabric material and hence imparts hydrophobicity to the insecticide. The composition includes also a dispersing agent that, after application of the composition to a fabric material and upon wetting of the material, reduces the hydrophobicity imparted to the insecticide by the copolymeric binder and hence permits controlled, limited insecticide release. Insecticide release thus occurs only in limited quantities at intervals, particularly in response to the fabric material being exposed to wetting, such as when it is washed. Insecticide is thus rendered bioavailable for killing insects after multiple washes.



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## TREATMENT OF FABRIC MATERIALS WITH AN INSECTICIDE

THIS INVENTION relates to the application of an insecticide to a fabric material.

The application of an insecticide to a fabric material is required in relation to fabric materials used for tents, clothing items, bed nets, tsetse-fly traps, and the like, particularly where these items are used to provide personal protection against insects and where this protection can be enhanced by killing the insects. Although the invention as hereinafter referred to provides particularly for the application of an insecticide to a fabric material suitable to form a mosquito net, the invention as hereinafter defined must be interpreted to extend to all other applications which can benefit from the application of an insecticide to a fabric material, and to which parameters as hereinafter set out apply.

In relation to a mosquito net, the application of an insecticide to the fabric material forming the net must provide for the insecticide to remain bioavailable for killing targeted insects, particularly mosquitoes, over an extended time period and particularly after several "washes" of the material. In order to accommodate this requirement it is known to apply the insecticide with the aid of a binder that binds the insecticide to the fabric material, while permitting continuous release of the insecticide at a controlled rate, in order to provide for the required bioavailability of the insecticide.

By providing for the insecticide to be released continuously, the binder also allows the insecticide to be washed out. As such, the binders used to date for the above purpose have not proven satisfactory, insofar as the associated insecticides lose their capability to kill insects after a very limited number of washes, i.e. between three and twenty washes. Clearly, where a binder does not permit the insecticide to be washed out, the insecticide may not be released at a sufficient rate and non-bioavailability of the insecticide can thus occur. The objectives of insecticide release at a sufficient rate and insecticide retention, particularly during washing, clearly constitute objectives that are contra-facilitatory and do not appear achievable.

It is thus an object of this invention to provide an alternative approach to the binding of an insecticide to a fabric material and, particularly, to provide an insecticide composition to which the above contra-facilitatory objectives do not apply and which permits an insecticide to be bound to a fabric material in a manner in which bioavailability of the insecticide for killing insects is maintained after multiple washes, particularly in the order of fifty washes, or more.

According to the invention there is provided an insecticide composition for application to a fabric material, which composition comprises a mixture including

an insecticide;

a copolymeric binder in a liquid form that permits application of the composition to a fabric material and that, after drying and while the fabric material is dry, imparts hydrophobicity to the insecticide; and

a dispersing agent that, after application of the composition to a fabric and upon wetting of the fabric, reduces the hydrophobicity imparted to the insecticide by the binder to permit limited insecticide release.

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The insecticide of the insecticide composition may be either one of a single insecticide and a mixture of insecticides selected from a group of insecticides that is suitable for application to mosquito nets. This group of insecticides may include synthetic pyrethroids such as those known in the trade as Alphacypermethrin, Cyfluthrin, 5 Deltamethrin, Etofenprox and Permethrin, other pyrethroids such as that known in the trade as Bifenthrin and non-pyrethroids such as that known in the trade as Carbosulphan. The insecticide also may be included in the insecticide composition as one of a water based insecticide concentrate and a solvent based insecticide concentrate, insecticide concentrates known in the trade as Cislin and K-Orthrine being 10 considered suitable.

The insecticide forming part of the insecticide composition of the invention also may be selected from other groups suitable for different applications.

The copolymeric binder of the insecticide composition of the invention may be prepared as a copolymer emulsion that is derived by an emulsion polymerisation 15 technique from monomers selected from at least one of the groups including:

- a) vinyl esters of aliphatic acid having 1 – 18 carbon atoms, such as vinyl acetate and vinyl versatate;
- b) acrylic and methacrylate esters of an alcohol having 1 – 18 carbon atoms, such as butyl acrylate, 2-ethylhexylacrylate, and methyl acrylate; and
- 20 c) mono and di-ethylenically unsaturated hydrocarbons, such as styrene, and aliphatic dienes, such as butadiene.

As such, the copolymeric binder, for use in the composition, may be prepared as a copolymer emulsion that is derived from monomers selected from the group including:

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- i) vinyl ester of versatic acid with butyl acrylate
- ii) vinyl ester of versatic acid with 2-ethylhexylacrylate
- iii) methylmethacrylate with 2-ethylhexylacrylate
- iv) styrene with 2-ethylhexylacrylate
- 5 v) styrene with butadiene
- vi) butadiene with acrylonitrile
- vii) styrene with butylacrylate
- viii) vinyl acetate with 2-ethylhexylacrylate

10 The copolymeric binder of the insecticide composition typically is a styrene 2-ethylhexylacrylate copolymer emulsion having a 50% total solids content prior to formulation as the insecticide composition for application to a fabric material.

15 The quantity of copolymeric binder may be variable and particularly is such that in relation to the quantity of insecticide forming part of the insecticide composition, it can impart required hydrophobicity to the insecticide, after application and drying of the composition on a fabric material. Various other monomers as listed above can be copolymerised to form copolymeric binders having the required properties needed to form the copolymeric binder component of the insecticide composition of the invention.

20 The dispersing agent as used in the insecticide composition of the invention comprises particularly a surface active agent that, with the insecticide composition applied to a fabric material, provides maximum separation of insecticide particles when the fabric is wetted. As such, the dispersing agent may be a polymeric electrolyte selected from a group including sodium silicates, polyphosphates and lignin derivatives.

25 The specific dispersing agent selected may be determined by the particular polymeric binder to be used as part of the composition of the invention, considering particularly the hydrophilic properties of the dispersing agent and the hydrophobic properties of the copolymeric binder.

It must be understood that the components of the insecticide composition of the invention can be separately provided, or can be provided in different combinations, requiring mixing and/or dilution before application. The invention accordingly extends also to the individual components when provided specifically to form the insecticide composition of the invention.

The insecticide composition of the invention may be applied to fabric materials before their formation into required products, i.e. while still in a yarn or sheet form, or after formation of relevant products.

Typical fabrics to which the insecticide composition of the invention may be applied may include the fabric materials commonly used for products such as tents, mosquito nets, and the like. As such, the insecticide composition of the invention may be particularly suitable for application to polyester netting as used for mosquito nets.

The insecticide composition of the invention may include also an adjuvant that, in use when applied as part of the insecticide composition to a fabric material, can serve to overcome resistance of particular insects to the insecticide included in the composition. As such, with the insecticide known in the trade as Deltamethrin being included in the insecticide composition, for killing particular type mosquitoes, the adjuvant may be piperonyl butoxide.

The insecticide composition of the invention may include also an anti-foam agent. Particularly, the anti-foam agent is a silicone anti-foam agent.

Still further, the insecticide composition of the invention may include UV blockers for protecting UV sensitive insecticides, as well as a disclosing agent that can serve to identify when a fabric to which the composition has been applied, requires application of fresh insecticide composition. The disclosing agent may be of a type that identifies when a fabric to which the composition has been applied requires fresh application of fresh insecticide composition by colour variations.

Further according to the invention there is provided, in combination, an insecticide composition in accordance with the present invention and a mosquito net of a fabric material, the insecticide composition being applied to the fabric material forming the mosquito net.

5 A particular example of an insecticide composition which is suitable for use in the treatment of polyester netting as used for mosquito nets is described hereafter, as well as the mode of use of the insecticide composition and the mode of release of the insecticide forming part of the composition, following application of the composition to a mosquito net.

10 The insecticide composition, suitable for use in the treatment of polyester netting as used for mosquito nets, in accordance with the invention, particularly includes

as insecticide 1,0 parts dry microcrystalline Deltamethrin;

as a copolymeric binder 25.0 parts wet styrene 2-ethylhexylacrylate copolymer emulsion at 50% total solids content;

15 as dispersing agent 73,5 parts wet 20% solution of sodium hexametaphosphate; and

1,5 parts wet silicone anti-foam agent at 20% solids content.

20 The insecticide composition is thus provided in a wet form in which it can be conveniently applied to the polyester netting to be treated, typically by a conventional application process such as by dipping, spraying, brushing, and the like. Following the application of the insecticide composition to the polyester netting it is allowed to dry, the copolymeric binder imparting sufficient hydrophobicity to the insecticide to prevent effectively the release of the insecticide from the composition as applied, i.e. from the netting, while retained in a dry form. Upon wetting of the netting, the dispersing

agent will reduce the hydrophobicity imparted to the insecticide, permitting limited release of the insecticide, effectively to the surface of the composition as applied to the polyester netting and, as such, effectively to the surface of the polyester netting. The quantity of insecticide so released particularly will be determined by the quantity of dispersing agent included in the insecticide composition.

It must be understood specifically in the above regard that by the suitable selection of a copolymeric binder and a dispersing agent, a precalculated and precisely controlled rate of insecticide release, as governed and maintained by the specific chemical reaction kinetics of that release, can be provided for. The chemical reaction kinetics may be particularly predetermined by virtue of being preset by the intimate contact of the types, amounts and proportions of the chemical reagents specifically selected to make up the composition. Different conditions and requirements can thus be taken into account in order to accommodate the formulation of the insecticide composition.

In use of a mosquito net, formed of polyester netting treated with the insecticide composition of the invention, the insecticide available on the surface of the polyester netting will fulfil the purpose of killing mosquitoes for as long sufficient insecticide is "exposed". By the normal washing of a treated mosquito net, the washing process will provide for additional insecticide to be released from the composition as applied to the mosquito net, thus rendering the net effective for killing mosquitoes for an additional time period.

By controlling the rate of release of the insecticide, the Applicants have established that the mosquito net can remain effective for killing mosquitoes even after fifty washes carried out in accordance with the World Health Organization Standard Methods.

Different insecticides, as well as both water-based and solvent based insecticide concentrates, can be utilized for different treatment applications, whereas different copolymeric binders also exist that are suitable for the purpose described and that can



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be used in combination with particular dispersing agents to provide for the required controlled release of the insecticide utilized, as described above. It is envisaged in this regard also that different fabric materials could be treated with different compositions, particularly to take into account the different applications of such materials and the different forms of protection to be provided by such materials.

Two particular alternative insecticide compositions for the purpose herein envisaged are as follows:

## Composition 1

10	Soln 1:	A	Dispersant	
			White spirits	92.60% (m/m)
			Phosphatides in form of soya lecithin	0.74%
		B	Monomer/Copolymer Binder	
15			Styrene-2ethylhexylacrylate	0.19%
	Soln 2:	C	Insecticide	
			Acetone	2.52%
			Deltamethrin	0.15%
			White Spirits	3.80%
20			Total	100.00%

## Composition 2

	Soln 1:	A	Dispersant	
			White spirits	46.08%
			Phosphatides in form of soya lecithin	0.37%
25		B	Surfactant	
			Synperonic NP9	0.15%

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	C	Monomer/Copolymer Binder	
		Styrene-2ethylhexylacrylate	0.10%
Soln 2:	D	Insecticide	
		Acetone	1.25%
5		Deltamethrin	0.15%
		White Spirits	1.90%
Soln 3:	E	Emulsifying Medium	
		Water	49.85%
		Synperonic NP9	0.15%
10		Total	100.00%

The insecticide composition as described above also may include UV blockers for protecting insecticides that could be exposed to deterioration as a result of UV radiation, whereas a disclosing agent also can form a part of the composition. The disclosing agent may be of a type that can indicate when re-treatment of a fabric material is necessary, the insecticide composition of the invention clearly being suitable to permit the multiple treatment of fabric materials.

The invention extends also to particular fabric materials treated with an insecticide composition, in accordance with the invention, as well as to particular products and, particularly, mosquito nets, formed of fabric materials treated with, or rendered suitable for treatment with, the insecticide composition of the invention.

CLAIMS

1. An insecticide composition for application to a fabric material, which composition comprises a mixture including

an insecticide;

- 5 a copolymeric binder in a liquid form that permits application of the composition to a fabric material and that, after drying and while the fabric material is dry, imparts hydrophobicity to the insecticide; and

- 10 a dispersing agent that, after application of the composition to a fabric and upon wetting of the fabric, reduces the hydrophobicity imparted to the insecticide by the binder to permit limited insecticide release.

2. An insecticide composition as claimed in Claim 1, in which the insecticide is either one of a single insecticide and a mixture of insecticides selected from a group of insecticides that is suitable for application to mosquito nets.

- 15 3. An insecticide composition as claimed in Claim 2, in which the group of insecticides includes synthetic pyrethroids such as those known in the trade as Alphacypermethrin, Cyfluthrin, Deltamethrin, Etofenprox and Permethrin, other pyrethroids such as that known in the trade as Bifenthrin and non-pyrethroids such as that known in the trade as Carbosulphan.

- 20 4. An insecticide composition as claimed in any one of Claims 1 to 3, in which the insecticide is included as one of a water-based insecticide concentrate and a solvent based insecticide concentrate.

5. An insecticide composition as claimed in any one of the preceding claims, in which the copolymeric binder for use in the composition is prepared as a

copolymer emulsion that is derived by an emulsion polymerisation technique from monomers selected from at least one of the groups including:

- a) vinyl esters of aliphatic acid having 1–18 carbon atoms, such as vinyl acetate and vinyl versatate;
- b) acrylic and methacrylate esters of an alcohol having 1–18 carbon atoms, such as butyl acrylate, 2-ethylhexylacrylate, and methyl acrylate; and
- (c) mono and di-ethylenically unsaturated hydrocarbons, such as styrene and aliphatic dienes such as butadiene

6. An insecticide composition as claimed in Claim 5, in which the copolymeric binder, for use in the composition, is prepared as a copolymer emulsion that is derived from monomers selected from the group including :

- i) vinyl ester of versatic acid with butyl acrylate;
- ii) vinyl ester of versatic acid with 2-ethylhexylacrylate;
- iii) methylmethacrylate with 2-ethylhexylacrylate;
- iv) styrene with 2-ethylhexylacrylate;
- v) styrene with butadiene;
- vi) butadiene with acrylonitrile;
- vii) styrene with butylacrylate; and
- viii) vinyl acetate with 2-ethylhexylacrylate.

7. An insecticide composition as claimed in Claim 6, in which the copolymeric binder is a styrene 2-ethylhexylacrylate copolymer emulsion having a 50% total solids content prior to formulation as the insecticide composition for application to a fabric material.

8. An insecticide composition as claimed in any one of the preceding claims, in which the dispersing agent comprises a surface active agent that, with the

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insecticide composition applied to a fabric material, provides maximum separation of insecticide particles when the fabric material is wetted.

- 5 9. An insecticide composition as claimed in Claim 8, in which the dispersing agent is a polymeric electrolyte selected from a group including sodium silicates, polyphosphates and lignin derivatives.
- 10 10. An insecticide composition as claimed in any one of the preceding claims, which includes an adjuvant that, in use when applied as part of the insecticide composition to a fabric material, can serve to overcome resistance of particular insects to the insecticide included in the composition.
- 10 11. An insecticide composition as claimed in Claim 10, in which the insecticide is the insecticide known in the trade as Deltamethrin, which is provided for killing particular type mosquitoes, and the adjuvant is piperonyl butoxide.
12. An insecticide composition as claimed in any one of the preceding claims, in which the mixture forming the composition includes an anti-foam agent.
- 15 13. An insecticide composition as claimed in Claim 12, in which the anti-foam agent is a silicone anti-foam agent.
14. An insecticide composition as claimed in any one of the preceding claims, in which the mixture forming the insecticide includes UV blockers.
- 20 15. An insecticide composition as claimed in any one of the preceding claims, in which the mixture forming the composition includes a disclosing agent that can serve to identify when a fabric to which the composition has been applied requires application of fresh composition.

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16. An insecticide composition as claimed in Claim 1, which comprises a mixture including

as insecticide 1,0 parts dry microcrystalline Deltamethrin;

as a copolymeric binder 25.0 parts wet styrene 2-ethylhexylacrylate copolymer emulsion at 50% total solids content;

as dispersing agent 73,5 parts wet 20% solution of sodium hexametaphosphate; and

1,5 parts wet silicone anti-foam agent at 20% solids content.

17. In combination an insecticide composition as claimed in any one of Claims 1 to 16 and a mosquito net of a fabric material, the insecticide composition being applied to the fabric material forming the mosquito net.

18. An insecticide composition substantially as described in the specification.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 02/04327

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A01N25/34 A01N25/10

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, CHEM ABS Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 202 243 A (KAZ BROZDOWSKI) 21 September 1988 (1988-09-21) the whole document ---	1-5,8,9, 18
X	US 4 623 540 A (COSTANZA ET AL.) 18 November 1986 (1986-11-18) the whole document ---	1,2,4-8, 18
X	DATABASE WPI Section Ch, Week 198610 Derwent Publications Ltd., London, GB; Class A97, AN 1986-064917 XP002227352 & JP 61 015801 A (YAMANAN GOSEI KAGAK), 23 January 1986 (1986-01-23) abstract --- -/--	1-5,8,18



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE CA 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; BISHOP, RICHARD TIMOTHY: "Control of the release of soil additives" retrieved from STN Database accession no. 96:212558 XP002227351 abstract & ZA 8 005 769 A (REVERTEX (PTY.) LTD., S. AFR.) 26 August 1981 (1981-08-26) -----	1,5,6,8, 18
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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

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